10. [15 points] Describe how depth-of-field should be implemented for ray tracing.

12. [10 points] Describe how soft shadows can be implemented for ray tracing.

3. [10 points] Describe stochastic supersampling and jittered stochastic supersampling. How are they similar? How are they different? Describe the algorithm used for jittered stochastic supersampling.

6. [20 points] This problem is about creating depth-of-field in ray tracing by jittering the eye position: this moves the eye position by choosing multiple jittered eye displacements for casting $k^2$ many rays and averaging the results. It is customary to use different jittered eye displacements for each pixel. Explain what kinds of problems could happen if instead the same jittered eye displacements were used for every pixel. (That is, instead of choosing different $k^2$ many random eye displacements for each pixel, you used the same $k^2$ eye displacements for all the pixels.) What kinds of undesirable visual effects might occur? Would these effects be more notice-able for objects near the focal plane, or far from the focal plane?

There may also be questions about B-spline interpolation; and B-spline derivatives; and shader programs including geometry shaders.
11. [10 points] (Radiosity) Explain what form factors $F_{i,j}$ are. Explain how ray tracing can be used to compute the form factors $F_{i,j}$. Do form factors need to be recomputed for each change in viewpoint?
1. A degree two Bezier curve $q(u)$ is defined to trace out the upper right quadrant of the unit circle in $\mathbb{R}^2$ centered at the origin, with control points $p_0 = \langle 1, 0, 1 \rangle$, $p_1 = \langle \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2} \rangle$ and $p_2 = \langle 0, 1, 1 \rangle$.

Each value $q(u)$ is equal to the homogeneous representation of a point $r(u)$ in $\mathbb{R}^2$.

**a.** What is $q'(0)$ equal to?

**b.** What is $r'(0)$ equal to? (If $q(u)$ is the homogeneous representation of the position of a point at time $u$, then $r'(0)$ is velocity of the point at time 0.)